



Chunghwa Picture Tubes, Ltd.

Technical Specification

To : **PROVIEW**

Date : 2009/02/09

CPT TFT-LCD
CLAB 215FA01

ACCEPTED BY :

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1. OVERVIEW

CLAB215FA01 is 21.5" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs and control circuit. By applying 6 bit digital data, 1920×1080, 16.7M-color images are displayed on the 21.5" diagonal screen. Input power voltage is 5.0V for LCD driving. General specification is summarized in the following table:

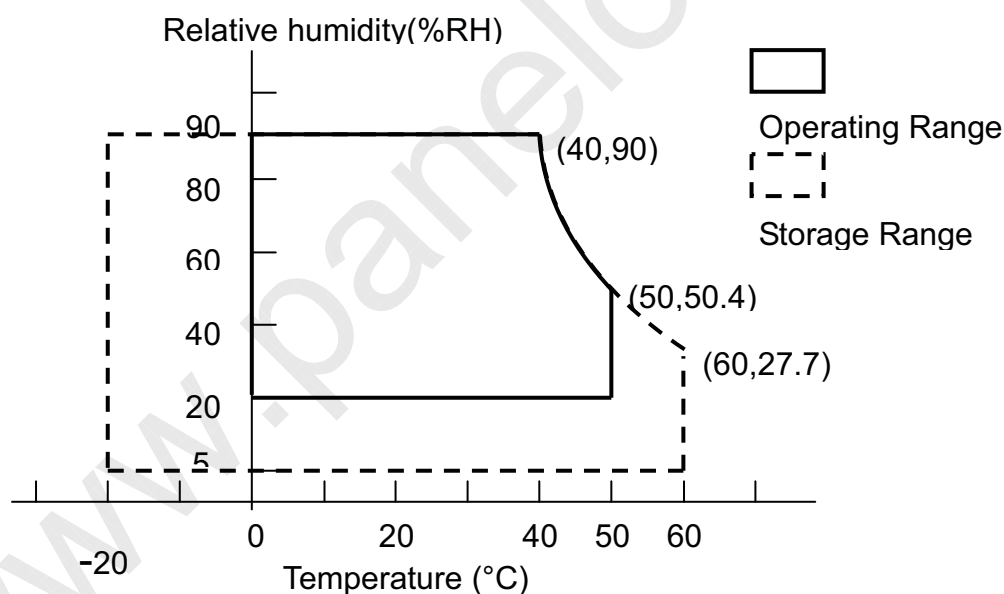
ITEM	SPECIFICATION
Display Area(mm)	476.64 (H) × 268.11 (V) (21.53-inch diagonal)
Number of Pixels	1920 (H) × 1080(V)
Pixel Pitch(mm)	0.24825 (H) × 0.24825 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white, TN
Number of Colors	16.7M(6bits+Hi-FRC)
Viewing Angle(H/V)	170/160 (Typ.)
Surface Treatment	Anti-glare, 3H

2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD	VCC	0	6	V	
static electricity	VESDt	-200	200	V	*4)
	VESDc	-8000	8000	V	
Operation Temperature	Top	0	50	°C	*1). 2). 3). 5)
Storage Temperature	Tstg	-20	60	°C	*1). 2). 3)
Delayed Discharge Time	TD	--	1	sec	*6)

[Note]

- 1).The relative temperature and humidity range are as below sketch, 90%RHMax.($T_a \leq 40^\circ\text{C}$).
- 2).The maximum wet bulb temperature $\leq 39^\circ\text{C}$ ($T_a > 40^\circ\text{C}$) and without dewing.
- 3).If you use the product in a environment which over the definition of temperature and humidity too long to effect the result of eye-etching.
- 4).Test Condition: IEC 1000-4-2 VESDt: Contact discharge to input connector; VESDc: Contact discharge to module
- 5).If you operate the product in normal temperature range, the center surface of panel should be under 60°C .
- 6).Delay lighting testing needs the volt above start voltage V_{rms} . Before the procedure tube needs typical lighting for 1 minute and stay in the temperature $25 \pm 2^\circ\text{C}$ for 24 hours and then testing in the same condition in dark room.



3. OPTICAL CHARACTERISTICS

Ta=25°C , VCC=5.0V

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Contrast (CEN)		CR	$\theta=\psi= 0^{\circ}$	800	1000	--	--	*1)*2)
Center Transmittance		T%	CPT BLU	4.09	4.64		%	*1)*3)
Response Time		Tr+Tf	$\theta=\psi= 0$	--	5	8	ms	*4)
View angle	Horizontal	ψ	$CR\geq 10$	150	170	--	Deg.	*5)
	Vertical	θ		140	160	--	Deg.	
	Horizontal	ψ	$CR\geq 5$	150	170	--	Deg.	
	Vertical	θ		150	170	--	Deg.	
Color Coordinates	Red	x	$\theta=\psi= 0^{\circ}$ CPTBLU	(0.622)	(0.652)	(0.682)	Base on (W _x , W _y) = (0.313 , 0.329)	
		y		(0.303)	(0.333)	(0.363)		
	Green	x		(0.259)	(0.289)	(0.319)		
		y		(0.577)	(0.607)	(0.637)		
	Blue	x		(0.117)	(0.147)	(0.177)		
		y		(0.055)	(0.085)	(0.115)		

[Note]

Color coordinate is measured by SRUL1R, response time is measured by TRD-100 and all the other items are measured by BM-5A (TOPCON). All these items are measured under the dark room condition (no ambient light).

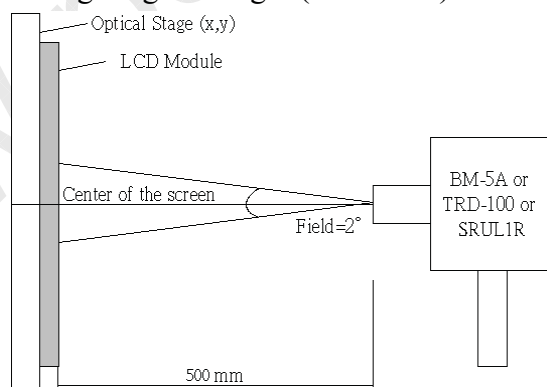
Measurement Condition: IL=7.5 mA × 4

Inverter: Sumida, model: TWS-400-9656 — — , Frequency=50kHz.

Definition of these measurement items is as follows:

1) Setup of Measurement Equipment

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight (CPT BLU) for 20 minutes and in a dark room.



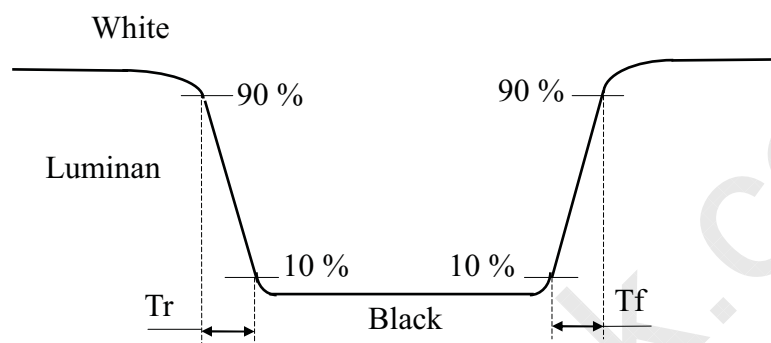
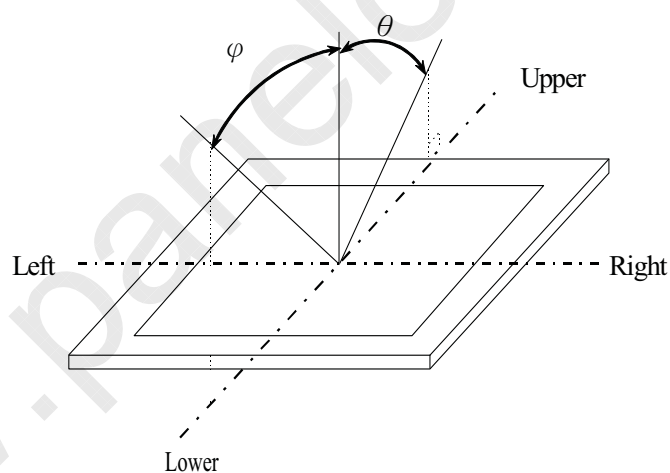
2) Definition of Contrast Ratio

CR=ON (White) Luminance/OFF (Black) Luminance

3) Definition of Transmittance (T %):

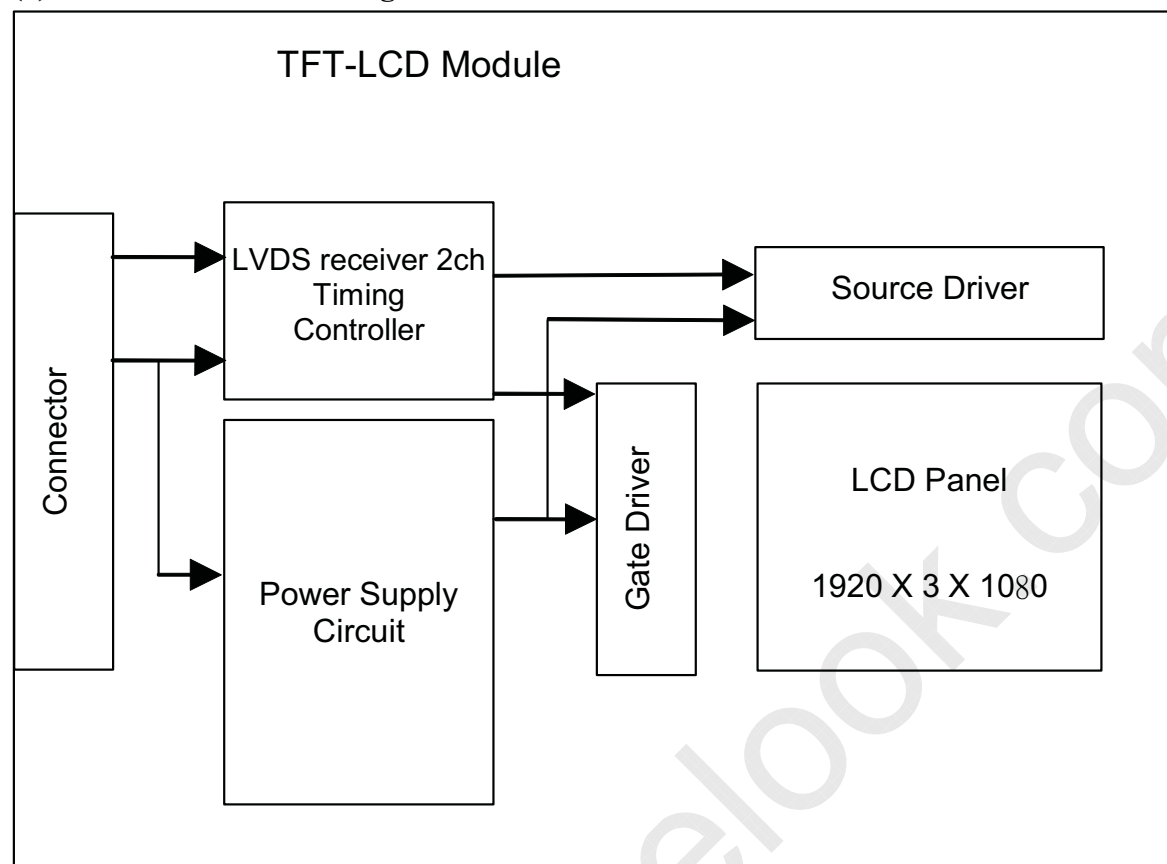
$$\text{Transmittance} = \frac{\text{Luminance of LCD module}}{\text{Luminance of backlight}} * 100\%$$

4) Definition of Response Time:

5).Definition of Viewing Angle (θ, ψ):

4. BLOCK DIAGRAM

(1) LCD Module Block Diagram



(2) Pixel Format

D(1,1)	D(2,1)	..	D(X,1)	..	D(1919,1)	D(1920,1)
D(1,2)	D(2,2)	..	D(X,2)	..	D(1919,2)	D(1920,2)
..	..	+	..	+
D(1,Y)	D(2,Y)	..	D(X,Y)	..	D(1919,Y)	D(1920,Y)
..	..	+	..	+
D(1,1079)	D(2, 1079)	..	D(X, 1079)	..	D(1919, 1079)	D(1920, 1079)
D(1, 1080)	D(2, 1080)	..	D(X, 1080)	..	D(1919, 1080)	D(1920,1080)



(3) Relationship between Displayed Color and Input

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB							LSB	MSB							LSB	MSB							LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

[Note] 1) Definition of gray scale: Color (n): n indicates gray scale level; higher n means brighter level.

2) Data: 1-High, 0-Low.

3) For odd & even data also.

5. INTERFACE PIN CONNECTION

Outlet connector: GS2330-0312R-7F (FOXCONN) (or equivalent)

PIN NO.	REMARK	FUNCTION
1	RXO0-	minus signal of odd channel 0(LVDS)
2	RXO0+	plus signal of odd channel 0(LVDS)
3	RXO1-	minus signal of odd channel 1(LVDS)
4	RXO1+	plus signal of odd channel 1(LVDS)
5	RXO2-	minus signal of odd channel 2(LVDS)
6	RXO2+	plus signal of odd channel 2(LVDS)
7	GND	GND
8	RXOC-	minus signal of odd clock channel (LVDS)
9	RXOC+	plus signal of odd clock channel (LVDS)
10	RXO3-	minus signal of odd channel 3(LVDS)
11	RXO3+	plus signal of odd channel 3(LVDS)
12	RXE0-	minus signal of even channel 0(LVDS)
13	RXE0+	plus signal of even channel 0(LVDS)
14	GND	GND
15	RXE1-	minus signal of even channel 1(LVDS)
16	RXE1+	plus signal of even channel 1(LVDS)
17	GND	GND
18	RXE2-	minus signal of even channel 2(LVDS)
19	RXE2+	plus signal of even channel 2(LVDS)
20	RXEC-	minus signal of even clock channel (LVDS)
21	RXEC+	plus signal of even clock channel (LVDS)
22	RXE3-	minus signal of even channel 3(LVDS)
23	RXE3+	plus signal of even channel 3(LVDS)
24	GND	GND
25	NC	NC
26	NC	Test pin (Can't connect to GND)
27	NC	NC
28	VCC	Power supply input voltage(5.0 V)
29	VCC	Power supply input voltage(5.0 V)
30	VCC	Power supply input voltage(5.0 V)

1) Keep the NC Pin and don't connect it to GND or other signals.

2) GND Pin must connect to the ground, don't let it be a vacant pin.

6. ELECTRICAL CHARACTERISTICS

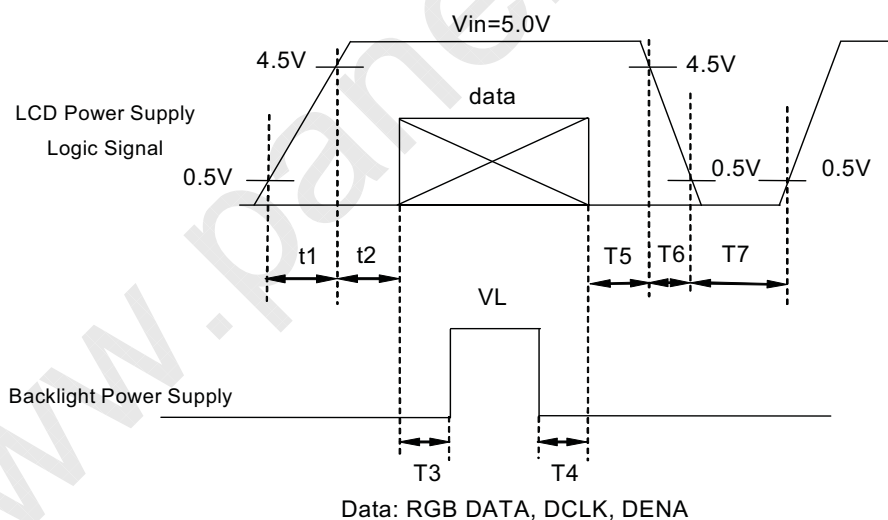
(1).TFT-LCD

Ta=25℃

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Power Supply Voltage for LCD		VCC	4.5	5.0	5.5	V	*1)
Power Supply Current for LCD		ICC	--	1000	1500	mA	*2)
Permissive Ripple Voltage for Logic		VRP	--	--	100	mVp-p	VCC=5.0V
Differential Resistance		Zm	90	100	110	Ω	
LVDS: IN+ , IN-	The same motion input Voltage	VCM	1.125	1.25	1.375	V	*3)
	Differential input Voltage	VID	250	350	450	mV	
	High electric potential threshold voltage	VTH	-	-	100	mV	
	Low electric potential threshold voltage	VTL	-100	-	-	mV	
LCD Inrush Current		Inrush	-	-	3	A	*4)
Power consumption		P	-	5	7.5	W	*2)

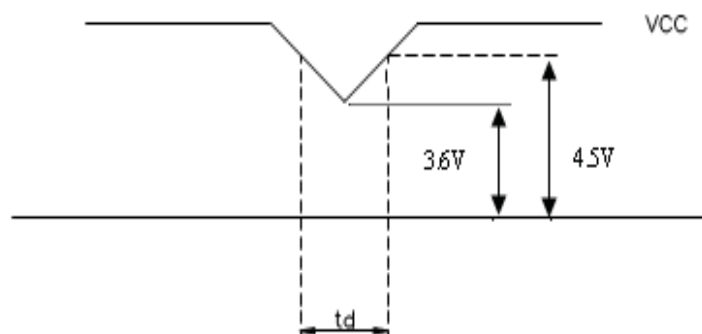
[Note]

*1)Power 、data sequence

 $0.5\text{ms} < t1 < 10\text{ms}$ $t4 > 200\text{ms}$ $t7 > 1\text{sec}$ $0 < t2 < 50\text{ms}$ $0 < t5 < 50\text{ms}$ $t3 > 250\text{ms}$ $0.01\text{ms} < t6 < 10\text{ms}$ 

VCC-dip conditions:

- (1) When $3.6\text{V} \leq V_{\text{CC}}(\text{min}) < 4.5\text{V}$: $t_d \leq 10\text{ ms}$
- (2) When $V_{\text{CC}} < 3.6\text{ V}$, VCC-dip conditions should also follow the VCC-turn-on conditions.

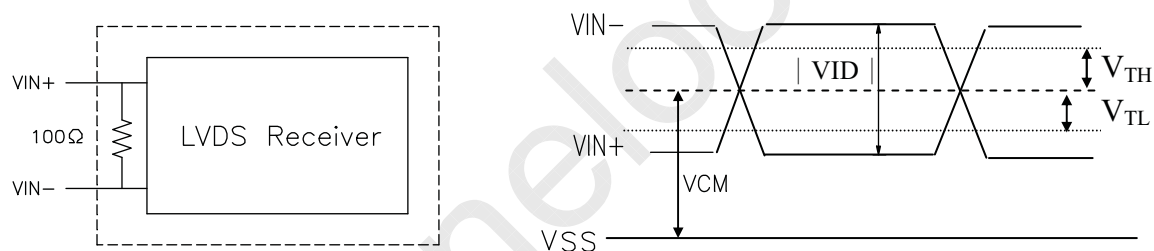


*2). Typical value is measured when displaying horizontal gray scale line pattern:

64 gray level, 1920 line mode

$V_{\text{CC}}=5.0\text{ V}$, $f_{\text{H}}= 66.9\text{ kHz}$, $f_{\text{V}}=60\text{ Hz}$, $f_{\text{CLK}}=77\text{ MHz}$

*3) LVDS Signal definition



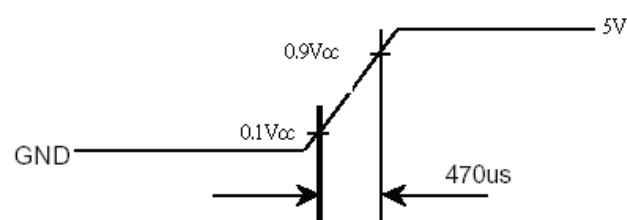
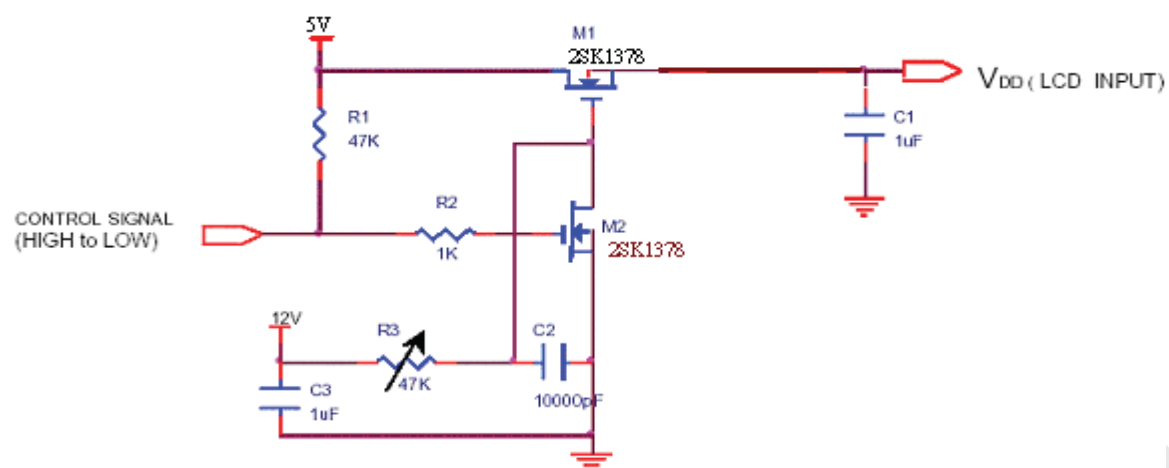
VIN+ : Positive differential DATA & CLK Input

VIN- : Negative differential DATA & CLK Input

*4).Irush Measurement Condition

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7. INTERFACE TIMING

(1) Timing Characteristic

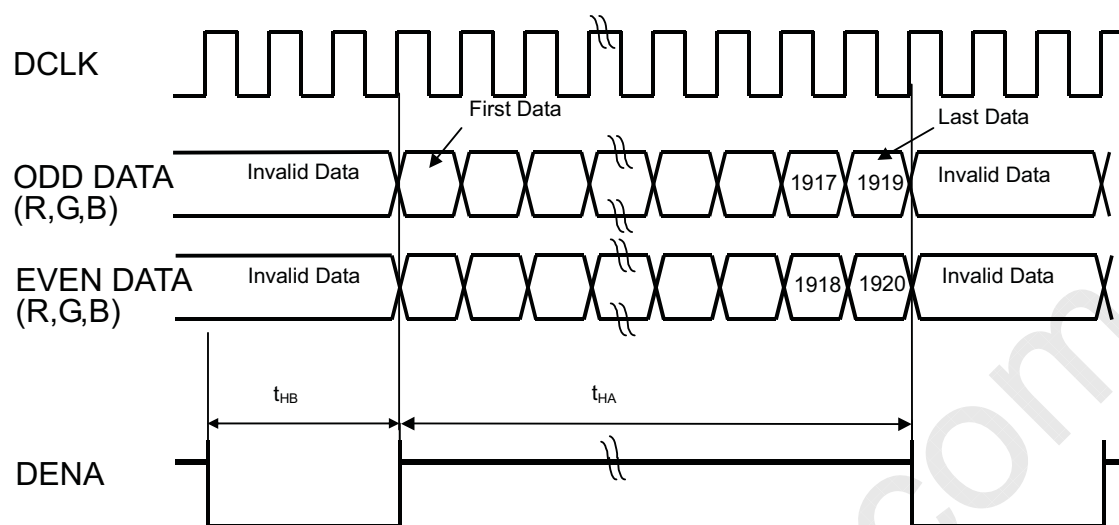
ITEM			SYMBOL	MIN.	TYP.	MAX.	UNIT	
LCD Timing	DCLK		Freq.	f _{CLK}	55	72	90	MHz
			Cycle	t _{CLK}	18.18	13.89	11.11	ns
	DENA	Horizontal	Horizontal effective time	t _{HA}	960	960	960	t _{CLK}
			Horizontal blank time	t _{HB}	32	100	115	t _{CLK}
			Horizontal total time	t _H	992	1060	1075	t _{CLK}
		Vertical	Vertical frame Rate	Fr	50	60	75	Hz
			Vertical total time	t _V	1084	1130	1170	t _H
			Vertical effective time	t _{VA}	1080	1080	1080	t _H
			Vertical blank time	t _{VB}	4	50	90	t _H

[Note]

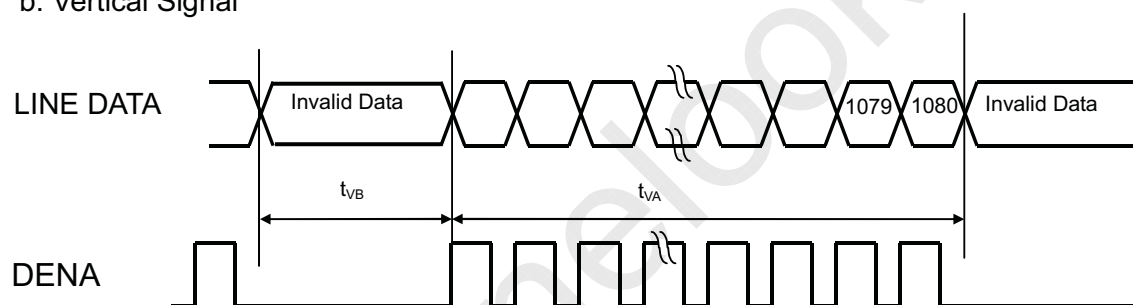
- *1) DENA (data enable) usually is positive
- *2) DCLK still inputs during blanking
- *3) LVDS transmitter IC: NT71679-00024(NVT)
- *4) DE mode only
- *5) It maybe cause flicker at 50Hz.

(2).Timing Chart

a. Horizontal Signal



b. Vertical Signal





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8. OUTLINE DIMENSION

